

**R E M A R K S**

Reconsideration of this application, as amended, is respectfully requested.

**RE: INTERVIEW**

The Examiner and her supervisor are thanked for conducting a telephone interview on October 24, 2006. The application has been amended along the lines agreed to by the Examiner and her supervisor to more clearly patentably distinguish over the prior art references of record. The amended claims more positively recite the subject matter agreed to patentably distinguish over the prior art references of record.

**THE CLAIMS**

Claims 1 and 3 have been amended to incorporate - and more positively recite - the subject matter of (now canceled) claims 10 and 11, respectively, in accordance with the disclosure in the specification at, for example, page 7, line 22 to page 9, line 13.

No new matter has been added, and it is respectfully requested that the amendments to claims 1 and 3 be approved and entered.

THE PRIOR ART REJECTION

Claims 1, 3, 7 and 9 were rejected under 35 USC 103 as being obvious in view of the combination of USP 6,464,332 ("Silverbrook") and USP 6,474,765 ("Beauchamp et al"); claims 4, 6, 12 and 14 were rejected under 35 USC 103 as being obvious in view of the combination of Silverbrook, Beauchamp et al and USP 6,775,022 ("Noyes et al"); and claims 10 and 11 were rejected under 35 USC 103 as being obvious in view of the combination of Silverbrook, Beauchamp et al and USP 5,898,443 ("Yoshino et al"). These rejections, however, are respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended claims 1 and 3, an image forming apparatus is provided which includes a line image determinator which determines whether or not image data corresponding to an overlapped region between (overlapped recording) heads is a line image, and wherein if the image data is found to be a line image, an image data distributor distributes the image data so that no complementary printing is performed in the overlapped region (formed between overlapping recording heads).

As explained in the specification of the present application with respect to Figs. 5A to 5C at page 8, line 17 to page 9, line 13, when two recording heads overlap, printing respective images using both of the recording heads simultaneously results

in overlapping printed images. To avoid this problem, the image data is distributed so as to alternately drive nozzles of the recording heads in the overlapped region, thereby performing "complementary printing." However, this complementary printing is best suited to a "natural image." On the other hand, as explained at the top of page 9 in the specification and in the Amendment filed on January 17, 2006, "if image data is found to be a line image, the image printed by complementary printing cannot be linear (the image is zigzagged), so no clear line image can be printed (FIG. 5B)." That is, when a line image is to be printed with a nozzle, by alternating printing between the nozzle of one recording head and the nozzle of the adjacent recording head, a zigzagged line is formed. See the four zigzagged lines in the overlapped region of the recording heads shown in Fig. 5B.

In view of this problem, according to the present invention as recited in amended claims 1 and 3, if the image data is found to be a line image, the image data is distributed by the image data distributor so that no complementary printing is performed in the overlapped region. That is, as explained at page 9, lines 6-13, the nozzles of only one recording head are driven, so that no "complementary printing" is performed, thereby achieving the clear line image shown in Fig. 5C.

The Examiner acknowledges on page 5 of the Office Action that Silverbrook and Beauchamp et al do not disclose the subject

matter of claims 10 and 11 (now recited in amended claims 1 and 3), and for this reason the Examiner has cited Yoshino et al to supply the missing teachings of Silverbrook and Beauchamp et al.<sup>1</sup>

It is respectfully submitted, however, that Yoshino et al does not explicitly disclose overlapping recording heads (and hence, Yoshino et al does not disclose an overlapped region) in the manner of the claimed present invention, as evidenced by, for example, column 12, lines 30-46 cited by the Examiner. In addition, it is respectfully submitted that Figs. 15A-15C of Yoshino et al cited by the Examiner do not relate to printing a line image or determining whether to perform complimentary printing between overlapping recording heads, in the manner of the claimed present invention.

Yoshino et al is directed to a printer that includes four typical ink cartridges (i.e., black, cyan, yellow and magenta), as well as a liquid ejecting ink cartridge that ejects a liquid to make the ink ejected by the other cartridges insoluble on the recording medium. (See column 6, lines 5-24 and column 14, lines 45-58, for example). Yoshino et al discloses several techniques for testing the printing of the nozzles of the various

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<sup>1</sup> At the bottom of page 5 of the Office Action, the Examiner refers to claims 12 and 13, but clearly intended to refer to claims 10 and 11.

cartridges. According to the embodiments shown in Figs. 1 and 12 of Yoshino et al, the cartridges/recording heads are mounted on a carriage and scanned across a recording medium. Thus, Figs. 1 and 12 of Yoshino et al do not relate to a recording head unit including a plurality of recording heads arranged such that an overlapped region is formed between the heads. Figs. 7 and 8 of Yoshino et al, moreover, show "full line type printing heads 2F to 2G." As described at column 12, lines 30-46 of Yoshino et al, in this mode the nozzles of the full line type printing heads may be divided into groups. However, it is respectfully submitted that Yoshino et al does not disclose that the full line type printing heads are divided into multiple recording heads along an arrangement direction of recording elements thereof, or that an overlapped region is formed between recording heads. Accordingly, it is respectfully submitted that Yoshino et al also does not disclose determining whether or not to perform complementary printing in an overlapped region between recording heads as according to the present invention as recited in amended claims 1 and 3.

Still further, it is respectfully pointed out that Figs. 15A to 15C of Yoshino et al also relate to an embodiment wherein the cartridges are arranged on a carriage and scanned across a recording medium. It is respectfully submitted, therefore, that Figs. 15A to 15C of Yoshino et al clearly cannot relate to

performing or not performing complementary printing of a line image in an overlapped region between recording heads (since, of course, the cartridges mounted on the carriage of Yoshino et al do not have overlapped regions in the manner of the claimed present invention).

In fact, Figs. 15A to 15C of Yoshino et al relate to an embodiment in which the liquid ejection head ejects liquid over every pixel printed by any one of the color ejection heads (C, Y, M, K). The liquid ejected by the liquid ejection head results in a water-resistant printed image. See column 15, lines 44-54. Figs. 15A to 15C of Yoshino et al show a technique for testing the individual nozzles of the liquid ejection head for non-ejection failure, in which one of the nozzles does not eject ink. Specifically, according to Yoshino et al, the black ink printing head prints a swathe of black ink using all of its nozzles. Fig. 15B shows the image printed by the black ink printing head. The liquid ejection head, on the other hand, prints individual lines with each of its nozzles, such that each nozzle prints one line. Fig. 15A shows the image printed by the liquid ejection head, and Fig. 15C shows the composite image produced by printing with both the liquid ejection head and the black ink printing head.

According to Yoshino et al, ink has a different quality when the liquid is ejected over printed ink. Therefore, locations

where the liquid has been ejected over printed ink can be distinguished from locations where the ink is present without any liquid printed thereon. Accordingly, in the pattern shown in Fig. 15C of Yoshino et al, if any of the nozzles of the liquid ejection head has failed to print, there will be a difference in quality of the black ink, as opposed to what the quality of the black ink would have been if the liquid had been ejected thereto. Thus, if one of the nozzles of the liquid ejection head fails, the failure can be detected, as shown in Fig. 16 of Yoshino et al (wherein the missing line indicates a failure of the nozzle of the liquid ejection head that should have printed that line).

It is respectfully submitted that printing a composite image test pattern as shown in Fig. 15C of Yoshino et al, for the purpose of detecting ejection failure of liquid from a liquid ejection head, clearly does not correspond to a line image determinator that determines whether or not image data which corresponds to an overlapped region between the (overlapped recording) heads is a line image, or to the feature of the present invention whereby if the image data is found to be a line image, an image data distributor distributes the image data so that no complementary printing is performed in the overlapped region (formed between overlapping recording heads), as according to the present invention as recited in amended claims 1 and 3.

Accordingly, it is respectfully submitted that the subject matter of amended claims 1 and 3 clearly patentably distinguishes over the combination of Silverbrook, Beauchamp et al and Yoshino et al, under 35 USC 103.

In view of the foregoing, it is respectfully submitted that the present invention as recited in amended independent claims 1 and 3, claims 4, 7 and 12 depending from claim 1, and claims 6, 9 and 14 depending from claim 3, clearly patentably distinguishes over all of the prior art of record, under 35 USC 102 as well as under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

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